Hazard Vulnerability Assessment (HVA)

Village of Key Biscayne, Florida

December 2006

Hazard Vulnerability Assessment (HVA)

for

The Village of Key Biscayne, Florida
Office of Emergency Management

December 2006

developed under contract by

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INTRODUCTION.

A. PREFACE.

1. One of the first and very important steps in the development of a comprehensive emergency management/community disaster planning process is the completion of a hazard analysis. The hazard analysis is the foundation for:

   - Mitigation Strategies.
   - Planning and Preparedness Activities.
   - Response (Estimate of "short-falls").
   - Recovery and Restoration.

2. Hazards are natural conditions or conditions created by people that can harm people, property or environment. Hazards exist at all times.

3. Hazard Analysis is defined as a systematic investigation of potential disasters.

4. It answers the question "what if?"

B. PURPOSE.

The purpose of this document is to give a general representation of hazards that threaten the Village of Key Biscayne, to identify impacts and consequences of each hazard, and to propose mitigation strategies.

C. BENEFITS OF A HAZARD VULNERABILITY ANALYSIS.

Benefits include:

- Realistic community disaster planning.
- Establishes emergency/disaster resource needs.
- Gives direction for mitigation programs.
- Provides incentive for a community emergency management program.
- Gives a focus for community preparedness training and education.
- Enables emergency managers to set priorities and goals commensurate with the degree of local public need for protection.
- Provides tools to raise the level of understanding of public officials and to influence the adoption of and expenditure for hazard prevention/mitigation measures.
- Justifies management decisions for altering program and staffing assignments that may vary from previous norms.
- Substantiates decisions about resource allocations and justifies budgets.
- Encourages identification of technological and research needs.

D. DEFINITIONS.

1. **Hazard:** Any situation, circumstance, or potential threat (either defined or perceived) that has the potential of causing great damage to life, property and/or environment.

2. **History:** The record of occurrence of previous disasters.

3. **Identification:** The location and description of places, property, or people requiring special planning that can be considered to be vulnerable to an actual or potential hazard.

4. **Maximum Threat:** The greatest potential destruction and/or loss of life that can be expected from an event.

5. **Mitigation:** Any activity, which can substantially reduce or moderate the damage effects of a hazard or disaster.

6. **Probability:** The likelihood that an event will occur.

7. **Risk:** The probability that damage to life, property and/or the environment will occur if a hazard manifests its potential. (Involves the element of change.)

8. **Source:** A person, circumstance or occurrence that may act as a point of origin of an event.

9. **Vulnerability:** The degree to which people, property, the environment, social or economic activity is susceptible to injury, damage, disruption or loss of life.

E. THE HVA PROCESS.

1. Hazard, risk, and impact assessment begins well before an emergency occurs. The Hazard Vulnerability Assessment Process flowchart, Table 1 of this chapter, illustrates activities necessary to identify/monitor the hazards, risks, and impacts for the Village of Key Biscayne.

2. Outline of the Hazard Assessment Development Process.

SECTION 1: COMMUNITY AT RISK.

Chapter 1 - Jurisdictional Data:
- I. Geographical.
- II. Topographical.
- III. Demographics.
- IV. Economic Profile Data.

Chapter 2 - Hazard Identification/Population at Risk:
- A. Natural.
- B. Technological.
- C. Civil/Political Disorder.

Chapter 3 - Risk Calendar & Risk Maps:
- A. Risk Calendar - Form A.
- B. Risk Maps - Form B.

SECTION 2: COMMUNITY ASSESSMENT.

Chapter 4 - Primary Effects of Hazards.

Chapter 5 - Probable Impacts of Hazards.

SECTION 3: MITIGATION.

Chapter 6 - Mitigation Strategies.

F. STATEMENT OF CONSISTENCY.

1. This comprehensive Hazards Vulnerability Assessment contains data consistent with the following:

- Village of Key Biscayne CEMP.
- Miami-Dade County CEMP.
- Village of Key Biscayne Local Mitigation Strategy.
- Miami-Dade County Local Mitigation Strategy.
- Village of Key Biscayne Mitigation Plan.

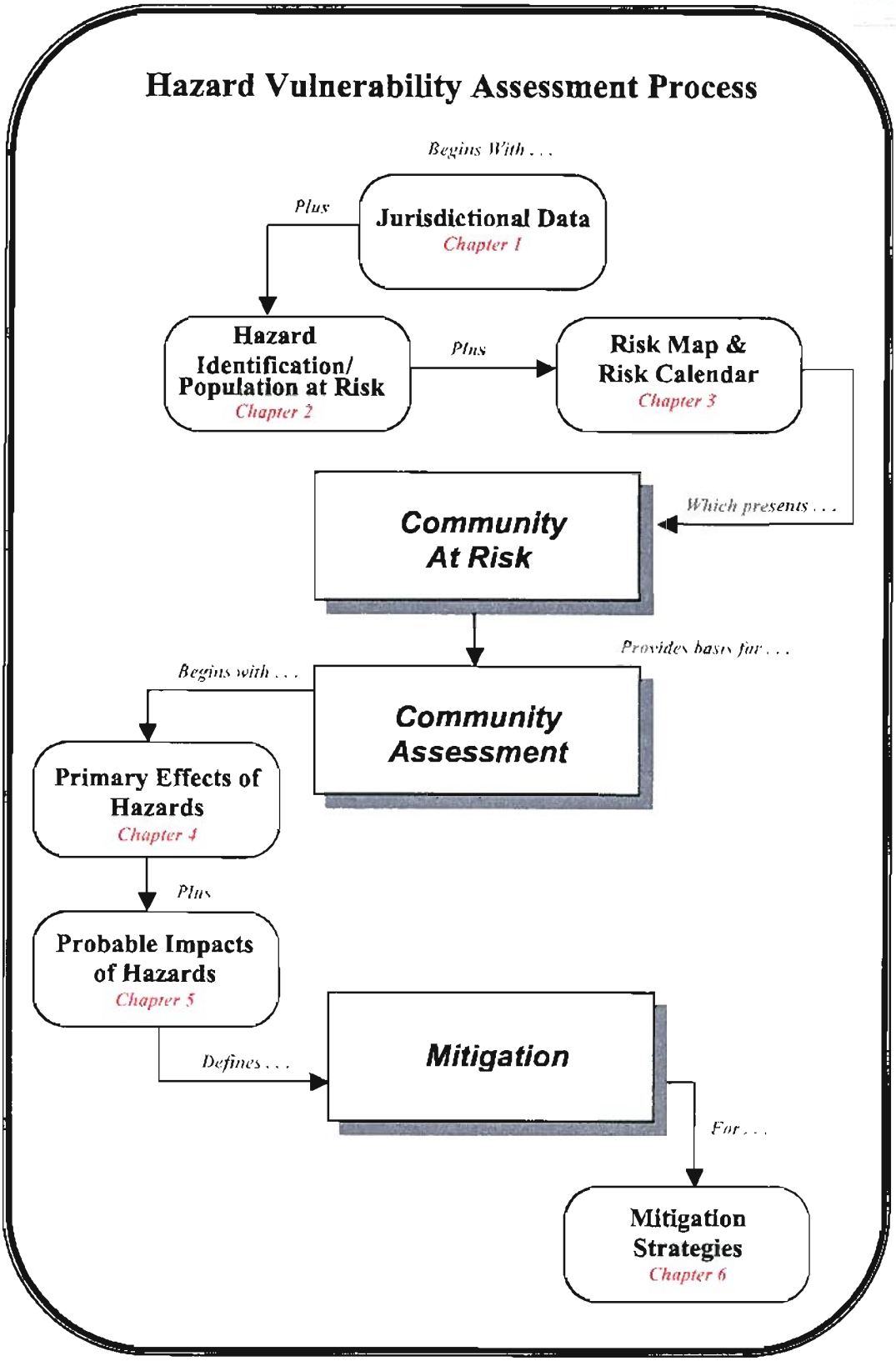

Table 1
Hazard Vulnerability Assessment Process

Executive Summary

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I. HAZARD IDENTIFICATION, RATINGS, AND RISK.

A. Significant Hazards Affecting the Village of Key Biscayne.

Based upon this Hazard Vulnerability Assessment and existing studies, Village of Key Biscayne is susceptible to the impact of numerous hazards. These hazards range from natural, technological to civil/political disorders. Table 1-1 in this section contains the list of hazards that are of most concern and are the focus of this report.

B. Hazard Frequency and Severity Summary is found on page ES-3 of this section.

C. Risk Assessment Summary is in Table 1-2 of this section.

Significant Hazards Affecting the Village of Key Biscayne

Natural	Technological	Human/Societal
• Epidemic, Human • Flood, Coastal/Intercoastal • Hurricane (Cat 1)/Tropical Storm (74-95 mph) • Hurricane, Category 2, 3, 4 and 5 • Storm, Lightning/Thunder • Storm, Surge • Tornado • Water Shortage	• Communications Failure • Fire, Explosion/Structural • Fuel/Resource Shortage • Power/Utility Outage • Radiological, Fixed Facility • Transportation Accident: Aircraft, Marine and Motor Vehicle	• Civil Disturbance: Demonstration/Illegal Assembly • Mass Immigration • Political Unrest • Terrorism: Explosion • Terrorism, WMD: Biological, Chemical, Nuclear

Table 1-1
Significant Hazards Affecting the Village of Key Biscayne

HAZARD FREQUENCY & SEVERITY SYSTEM

	Not Occurred	Low	Medium	High
Catastrophic	• WMD: Nuclear, Chemical, Biological • Terrorism-Explosion		• Hurricane: Category 4 & 5	
Critical	• Radiological, Fixed Facility		• Epidemic, Human	• Hurricane: Cat 2 & 3 • Tornado • Mass Immigration • Transportation Accident
Limited			• Storm Surge • Fire-Explosion/ Structural	• Civil Disturbance • Fuel/Resource Shortage • Hurricane (Cat 1)/ Tropical Storm • Storm: Lightning/ Thunder • Political Unrest • Power/Utility Outage
Negligible	• Communication Failure			• Floods, Coastal/ Intercoastal • Water Shortage

Frequency

High	At least one occurrence every 1 - 4 years.
Medium	At least one occurrence every 5 - 10 years.
Low	At least one occurrence every 11 - 100 years.
N/O	Has not occurred, but for planning purposes should be evaluated as part of jurisdictions HVA.

Severity

Catastrophic:	More than 50 deaths/injuries; Complete shutdown of critical facilities for 30 days or more; More than 50% property damage; Severe long-term effects on economy; Severely affects state/local/private sectors capabilities to begin or sustain recovery activities; Overwhelms local and state response resources.
Critical:	10-50 deaths/injuries; Shutdown of critical facilities for 8-30 days; 25-50% property damage; Short-term effect on economy; Temporarily (24-48 hours) overwhelms response resources.
Limited:	Less than 10 deaths/injuries; Shutdown of critical facilities for 3-7 days; 10-25% property damage; Temporary effect on economy; No effect on response system.
Negligible:	Minor injuries, no deaths; Shutdown of critical facilities for less than 3 days; Less than 10% property damage; No effect on economy; No effect on response system.

Note: The category of Severity is used if the hazard results in one or more of the qualifiers.

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COOP Risk Assessment

Location/Facility: Village of Key Biscayne

Date Completed: 11/18/06

Type of Hazard	Historical Occurrence	Prob. of Occurrence	Human Impact	Property Impact	Business Impact	Mitigation Activities	Internal Resources	External Resources	Total
Epidemic, Human	1	5	3	3	4	2	3	4	3.7
Flood, Coastal/Intercoastal	5	5	3	3	4	2	3	4	4.6
Hurricane (CAT 1)/Tropical Storm	5	5	3	3	4	2	3	4	4.6
Hurricane, Category 2-5	5	5	3	5	5	2	3	4	5.2
Storm, Lightning/Thunder	5	5	3	1	3	2	3	4	3.9
Storm, Surge	5	5	3	3	3	2	3	4	4.3
Tornado	5	5	3	3	3	2	3	4	4.3
Water Shortage	1	1	5	3	4	1	1	4	2.7
Communication Failure	5	4	3	2	2	1	1	4	3.8
Fire: Explosion/Structural	5	5	2	3	3	4	3	4	3.9
Fuel/Resource Shortage	4	3	2	2	4	3	1	4	3.1
Power/Utility Outage	5	3	2	3	4	3	1	4	3.6
Radiological, Fixed Facility	1	1	1	5	5	1	1	4	2.4
Transportation Accident: Aircraft, Marine, Motor Vehicle	5	5	3	3	3	2	3	4	4.3
Civil Disturbance: Demonstration/ Illegal Assembly	4	5	3	2	2	1	3	4	3.8
Mass Immigration	5	5	3	2	2	1	3	4	4.0
Political Unrest	4	5	3	2	2	1	3	4	3.8
Terrorism: Explosion	4	4	3	4	3	1	2	4	4.1
Terrorism, WMD: Biological, Chemical, Nuclear	1	1	1	5	5	1	3	4	2.2

LEGEND/ANALYSIS RESULTS:

High Risk: Greater than 3.5

Medium Risk: 2.0 to 3.5

Low Risk: Less than 2

Table 1-2
Hazard Risk Assessment

Instructions for Using the Spreadsheet

This Risk Assessment tool is an Excel spreadsheet, which is designed to measure a community's risk from the effects of various hazards. The tool is based on a formula that weighs the probability and severity of potential impacts against preparations in place which are intended to minimize these impacts. Using a simple 1 to 5 scale, the probability of occurrence and the impact potential are tabulated along with mitigation efforts and the resources available to respond to the hazard. The score is based on a formula that weighs risk heavily but provides credit for mitigation and response and recovery resources. The higher the score, the higher the community's risk from the hazard.

Instructions.

Using the guidelines shown below, score each hazard in all columns based on a scale of 1 to 5 with 5 being the highest.

Scoring Guidelines.

There are eight risk assessment factors contained in the spreadsheet. All factor scoring is done on a scale of 1-5. The formula contained in the spreadsheet calculates higher scores in the occurrence and impact columns as increasing risks, while higher scores in the mitigation and resource categories lower the overall risk score giving credit for steps taken to reduce the likely impact. Base your scoring on a "worst-case scenario." The following guidelines will assist you in scoring each hazard.

Historical Occurrence (Frequency):

Based on the number of occurrences: At least one occurrence every 1-4 years = 5; At least one occurrence every 5-10 years = 4; At least one occurrence every 11-50 years = 3; At least one occurrence every 51-100 years = 2; Has not occurred, but for planning purposes should be evaluated = 1.

Probability of Occurrence:

Based on the statistical probability of the hazard occurring in a given year. This may be obtained by scientific research or may simply be an educated guess. The higher the probability, the higher the score. Use the following guideline in determining you score. If less than 5% score 1, if 5% to 10% score 2, if 10% to 20% score 3, if 20% to 40% score 4, and score 5 if greater than 40% probability.

Human Impact:

Score based on greatest possible impact should worst-case event occur. Consider the likely number of fatalities, injuries, homeless, etc. Score 1 low - 5 highest.

Property Impact:

Score based on the economic costs of the event, including both direct and indirect property damage from the hazard. Score 1 low - 5 highest.

Business Impact:

Score based on factors such as service impact, lost wages, revenues, and taxes. Consider cost of relocation, permanent damage to valuable resources, etc. Score 1 low - 5 highest.

Mitigation Activities:

Based on steps taken to mitigate the hazard. The more mitigation measures taken, the higher the score. Score 1 low - 5 highest.

Internal Resources:

Base your score on the internal response and recovery resources. Score 1 low - 5 highest.

External Resources:

Base your score on the external resources that would be immediately available. Score 1 low - 5 highest.

Understanding the Scores:

Based on the weighted scoring formula hazards that are relatively high will score 3.5 or higher. The spreadsheet is programmed to change colors based on the score as follows:

Red	High Risk	Greater than 3.5
Yellow	Medium Risk	From 2.0 to 3.5
Green	Low Risk	Less than 2.0

These scores are based on subjective judgments but, nonetheless, they provide a means to quickly rate the community's risk from various hazards. Based on this risk scoring, priorities for increased mitigation and preparedness activities can be determined.

II. DESCRIPTION OF SIGNIFICANT HAZARDS AND IMPACTS.

NATURAL

A. EPIDEMIC, HUMAN

The occurrence in a community of cases of an illness where the frequency is clearly in excess of normal expectancy. The number of cases indicating an epidemic will vary according to the infectious agent, size and type of the population exposed, previous experience or lack of exposure to the disease, and time and place of the occurrence.

A. EPIDEMIC, HUMAN					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
• 12 Hours +	• Other	• Disrupted Commercial Services • Disrupted Government Services • Health/Epidemic • Human Safety • Isolated Areas • Mass Casualties • Multiple Deaths • Psychological Hardship	• Air Transportation Disruption	Business Interruptions: • Temporary Unemployment: • Short Term	• Other

B. FLOOD, COASTAL/INTERCOASTAL.

Much of Key Biscayne is susceptible to localized flooding, particularly during the rainy season of June through October. This rainfall pattern coupled with the hurricane season (June through November) makes Key Biscayne particularly vulnerable to flooding associated with late season tropical storms and hurricanes because they typically occur when the water table is high and the ground is saturated.

The topography of Key Biscayne is relatively flat. This results in extensive "ponding" due to the lack of elevation gradients to facilitate "run-off". Serious flooding can occur due to poor percolation rates and low elevations.

The South Florida Water Management District (SFWMD) is responsible for water management in Miami-Dade County. The system is designed to retain water in certain areas and, through a series of flood control gates, drain the excess water into Biscayne and Florida Bays. The bay salinity constraints limit this drainage system to a maximum flow of one inch of water drained every twenty four-hours.

B. FLOOD, COASTAL/INTERCOASTAL					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
3-6 Hours	• Fast Moving Water • Excessive Water	• Debris in Streets • Disrupted Commercial	• Damaged Buildings-Commercial	Business Interruptions: • Temporary	• Damage to Critical Environmental Resources

B. FLOOD, COASTAL/INTERCOASTAL					
	(flooding) • Ground Displacement • Soil/Beach Erosion (wind, water) • Tidal Waves/ Tidal Surge • Tsunami/Seiche	Services • Disrupted Government Services • Displaced Populations • Human Safety • Isolated Areas • Mass Casualties • Multiple Deaths • Psychological Hardship • Stranded	• Damaged Buildings-Public (Critical Facilities) • Damaged Buildings-Public (Essential Services) • Damaged Buildings-Public (General Use) • Damaged Buildings-Residential • Damage to Identified Historical/Cultural Resources • Electric Power Outage • Navigable Waterway Impairment • Petroleum Products (Gas/Oil) Loss or Disruption • Pipeline Systems Loss or Disruption • Sewer System Loss or Disruption • Stormwater Drainage Impairment • Surface (Road/Rail) Transportation Loss or Disruption • Telecommunications System Loss or Disruption • Water System Loss or Disruption	Loss of Capital Stock, Loss of Tax Base Unemployment: • Short Term	• Erosion, Water/Wind • Soil Contamination • Water Pollution

C. HURRICANE (CAT 1)/TROPICAL STORM.

Florida is the most vulnerable state in the nation to the impacts of hurricanes and tropical storms. South Florida is particularly exposed to the dangers presented by hurricanes, due to its topography.

Southeast Florida has experienced 28 hurricanes in the period from 1890 through 2004. Twelve of these storms have been "major Hurricanes" (Category 3 or above). The highest incidence of hurricane strikes occurs in the months of September and October.

The hurricane threat to Key Biscayne is exacerbated by the fact that the Village has a relatively low and flat topography.

Although the evacuation of Village residents and visitors is achievable, the clearance times for a fast moving Category 4 or 5 hurricane could require evacuation start times which are beyond our current ability to accurately predict a storm's actual landfall and intensity. The clearance time situation becomes even worse if the size of the storm, or its predicted landfall, requires the evacuation of adjacent counties.

The threat from storm surge represents a serious hazard. A storm surge is a large dome of water often 50 to

100 miles wide and rising anywhere from 4 to 5 ft in a category 1 hurricane up to 20 ft in a category 5 storm. The storm surge arrives ahead of the storm's actual landfall and the more intense the hurricane is, the sooner the surge arrives. Water rise can be very rapid, posing a serious threat to those who have waited to evacuate flood prone areas. A storm surge is a wave that has outrun its generating source and become a long period swell. The surge is always highest in the right-front quadrant of the direction the hurricane is moving in. As the storm approaches shore the greatest storm surge will be to the north of the hurricane eye.

Such a surge of high water topped by waves driven by hurricane force winds can be devastating to coastal regions. The stronger the hurricane and the shallower the offshore water, the higher the surge will be. In addition, if the storm surge arrives at the same time as the high tide, the water height will be even greater. The storm tide is the combination of the storm surge and the normal astronomical tide.

Hurricane damage is caused by two factors: high winds and storm surge. Damage during hurricanes may also result from spawned tornadoes and inland flooding associated with heavy rainfall that usually accompanies these storms.

In addition, flooding due to torrential rainfall (inundation) could pose a serious threat in portions of Miami-Dade County.

Pre-landfall hazards associated to a hurricane also pose a significant threat to a successful evacuation. The natural tendency to delay evacuation until the last minute may trap residents on roadways due to traffic jams or flooded evacuation routes. The torrential rains associated with the outer bands of a hurricane frequently render evacuation routes impassable long before the predicted landfall of the storm.

C. HURRICANE (CAT 1)/TROPICAL STORM

Warning Time	Primary Effects of Hazard	Impacts on People	Impacts on Property/Facilities/ Infrastructure	Impacts on Economy	Impacts on Environment
12+ Hours	• Fast Moving Water • Excessive Water (flooding) • High Wind/Excessive Wind • Soil/Beach Erosion (wind, water) • Tidal Waves/ Tidal Surge	• Air Quality • Debris in Streets • Disrupted Commercial Services • Disrupted Government Services • Displaced Populations • Downed Power Lines • Human Safety • Isolated Areas • Multiple Deaths • Psychological Hardship • Stranded	• Air Transportation Disruption • Bridges/Roads • Damaged Buildings-Commercial • Damaged Buildings-Public (Critical Facilities) • Damaged Buildings-Public (Essential Services) • Damaged Buildings-Public (General Use) • Damaged Buildings-Residential • Damage to Identified Historical/Cultural Resources • Electric Power Outage • Media (Radio/TV/Print) Loss or Disruption • Navigable Waterway Impairment • Petroleum Products	Business Interruptions: • Temporary Loss of Capital Stock, Loss of Tax Base Unemployment: • Short Term	• Damage to Critical Environmental Resources • Erosion, Water/Wind • Soil Contamination • Water Pollution

C. HURRICANE (CAT 1)/TROPICAL STORM					
			(Gas/Oil) Loss or Disruption • Pipeline Systems Loss or Disruption • Sewer System Loss or Disruption • Storm Water Drainage Impairment • Surface (Road/Rail) Transportation Loss or Disruption • Telecommunications System Loss or Disruption • Water System Loss or Disruption Loss or Disruption		

D. HURRICANE (CAT 2-5).

See description in previous section: HURRICANE (CAT 1)/TROPICAL STORM.

D. HURRICANE (CAT 2-5)					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
12+ Hours	• Fast Moving Water • Excessive Water (flooding) • High Wind/Excessive Wind • Soil/Beach Erosion (wind, water) • Tidal Waves/ Tidal Surge	• Air Quality • Debris in Streets • Disrupted Commercial Services • Disrupted Government Services • Displaced Populations • Downed Power Lines • Entrapment • Health/Epidemic • Human Safety • Isolated Areas • Mass Casualties (CAT 4-5) • Multiple Deaths • Psychological Hardship • Stranded	• Air Transportation Disruption • Bridges/Roads • Building/Structure Collapse • Damaged Buildings-Commercial • Damaged Buildings-Public (Critical Facilities) • Damaged Buildings-Public (Essential Services) • Damaged Buildings-Public (General Use) • Damaged Buildings-Residential • Damage to Identified Historical/Cultural Resources • Electric Power Outage • Media (Radio/TV/Print) Loss or Disruption • Navigable Waterway Impairment	Business Interruptions: • Permanent (CAT 4-5) • Temporary Loss of Capital Stock, Loss of Tax Base Unemployment: • Long Term • Short Term	• Damage to Critical Environmental Resources • Erosion, Water/Wind • Soil Contamination • Water Pollution

D. HURRICANE (CAT 2-5)					
			• Petroleum Products (Gas/Oil) Loss or Disruption • Pipeline Systems Loss or Disruption • Sewer System Loss or Disruption • Storm Water Drainage Impairment • Surface (Road/Rail) Transportation Loss or Disruption • Telecommunications System Loss or Disruption • Water System Loss or Disruption Loss or Disruption		

E. STORM LIGHTING/THUNDER.

A severe thunderstorm is defined as a thunderstorm containing one or more of the following phenomena: hail 3/4" or greater, winds gusting in excess of 57.5 mph, and/or a tornado. Severe weather can include lightning, tornadoes, damaging straight-line winds, and large hail. Most individual thunderstorms only last several minutes, however some can last several hours. Thunderstorms are common in Key Biscayne.

Severe thunderstorms and lightening strikes are traditionally responsible for the most frequent damage in Key Biscayne. Windstorm damage resulting from downbursts and squall lines frequently take down trees and power lines.

A dangerous and costly effect of thunderstorms is lightning. On average, more people are killed by lightning than any other weather event. Florida leads in the nation in lightning related deaths and injuries (National Lightning Safety Institute). Florida also has the most strikes, about 12 strikes per square kilometer per year in some places (National Lightning Safety Institute). The peak months for lightning strikes are June, July, and August, but no month is safe from lightning danger.

E. STORM LIGHTING/THUNDER					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
3-6 Hours	• Damaging Hail • Excessive Water (flooding) • High Wind/ Excessive Wind	• Debris in Streets • Disrupted Commercial Services • Disrupted Government Services • Downed Power Lines • Human Safety • Isolated Areas • Mass Casualties	• Damaged Buildings-Commercial • Damaged Buildings-Public (Critical Facilities) • Damaged Buildings-Public (Essential Services) • Damaged Buildings-Public (General Use)	Business Interruptions: • Temporary Loss of Capital Stock, Loss of Tax Base	• Damage to Critical Environmental Resources

E. STORM LIGHTING/THUNDER					
			• Damaged Buildings-Residential • Electric Power Outage • Media (Radio/TV/Print) Loss or Disruption • Sewer System Loss or Disruption • Storm Water Drainage Impairment • Telecommunications System Loss or Disruption • Water System Loss or Disruption		

F. STORM SURGE.

Storm surge is an onshore rush of water associated with a low pressure weather system. Storm surge is caused primarily by high winds pushing on the ocean's surface. The wind causes the water to pile up higher than the ordinary sea level. Low pressure at the center of a weather system also has a small secondary effect. It is this combined effect of low pressure and persistent wind over a shallow water body which is the most common cause of storm surge flooding problems.

Storm surges are particularly damaging when they occur at the time of a high tide, combining the effects of the surge and the tide. This increases the difficulty of predicting the magnitude of a storm surge since it requires weather forecasts to be accurate to within a few hours.

The most extreme storm surge events occur as a result of extreme weather systems, such as tropical cyclones, but storm surges can also be produced by less powerful storms.

F. STORM SURGE					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
)2 Hours +	• Fast Moving Water • Excessive Water (flooding) • Soil/Beach Erosion (wind, water) • Tidal Waves/ Tidal Surge	• Debris in Streets • Disrupted Commercial Services • Disrupted Government Services • Displaced Populations • Human Safety • Isolated Areas	• Bridges/Roads • Building/Structure Collapse • Damaged Buildings-Commercial • Damaged Buildings-Public (Critical Facilities) • Damaged Buildings-Public (Essential Services) • Damaged Buildings-Public (General Use) • Damaged Buildings-Residential	Business Interruptions: • Temporary Loss of Capital Stock, Loss of Tax Base Unemployment: • Short Term	• Damage to Critical Environmental Resources • Erosion, Water/Wind • Soil Contamination • Water Pollution

F. STORM SURGE					
			• Damage to Identified Historical/Cultural Resources • Electric Power Outage • Petroleum Products (Gas/Oil) Loss or Disruption • Pipeline Systems Loss or Disruption • Sewer System Loss or Disruption • Storm Water Drainage Impairment • Surface (Road/Rail) Transportation Loss or Disruption • Water System Loss or Disruption		

G. TORNADO.

The number of tornadoes in Florida generally increases during the months of June, July, and August with a decline in October, November, and December. Tropical cyclones tend to increase the occurrence of tornadoes during the late summer and early fall. Tornadoes during the winter and spring tend to be more powerful though due to the presence of the jet stream. Historically, Florida experiences stronger and more dangerous tornadoes in February, March, and April.

Unlike the rest of the nation, strong to violent tornadoes in Florida are just as likely to occur after midnight as they are during the afternoon. This unique feature makes Florida tornadoes very dangerous because most people are asleep and unable to receive adequate weather warnings.

G. TORNADO					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
Minimal-No	• Damaging Hail • High Wind/ Excessive Wind	• Debris in Streets • Disrupted Commercial Services • Disrupted Government Services • Displaced Populations • Downed Power Lines • Entrapment • Health/Epidemic • Human Safety • Isolated Areas • Mass Casualties • Multiple Deaths • Psychological	• Bridges/Roads • Building/Structure Collapse • Damaged Buildings-Commercial • Damaged Buildings-Public (Critical Facilities) • Damaged Buildings-Public (Essential Services) • Damaged Buildings-Public (General Use) • Damaged Buildings-Residential	Business Interruptions: • Permanent • Temporary Loss of Capital Stock, Loss of Tax Base Unemployment: • Long Term • Short Term	• Damage to Critical Environmental Resources • Erosion, Water/Wind • Soil Contamination • Water Pollution

G. TORNADO					
		• Hardship • Stranded	• Damage to Identified Historical/Cultural Resources • Electric Power Outage • Media (Radio/TV/Print) Loss or Disruption • Navigable Waterway Impairment • Petroleum Products (Gas/Oil) Loss or Disruption • Pipeline Systems Loss or Disruption • Sewer System Loss or Disruption • Storm Water Drainage Impairment • Surface (Road/Rail) Transportation Loss or Disruption • Telecommunications System Loss or Disruption • Water System Loss or Disruption		

H. WATER SHORTAGE/ DROUGHT.

Drought originates from a deficiency of precipitation over an extended period of time, usually a season or more, or a lack of water levels on the ground. A few examples of direct impacts of drought are: reduced crop, rangeland, and forest productivity; increased fire hazard; reduced water levels; increased livestock and wildlife mortality rates; and damage to wildlife and fish habitat. Social impacts include public safety; health; conflicts between water users; reduced quality of life; and inequities in the distribution of impacts and disaster relief. Income loss is another indicator used in assessing the impacts of drought.

Drought in South Florida is associated with increases in insect infestations, plant disease, and wind erosion.

In South Florida crops are grown year round with the primary season between October and March. Local agriculture is susceptible to freezes, drought, flooding, diseases, and pests. Since the primary growing season does not coincide with the rainy season, most of the water needed to irrigate crops is well water. In times of drought, the use of well water for crop irrigation lowers the water table, which exposes the water table to salt water intrusion and a serious compromise of county potable water supplies.

Miami-Dade County obtains its potable water supply from the Biscayne Aquifer, which is primarily replenished by rainwater. In times of drought, water can be supplied by the South Florida Water Management District regional system, which originates in a number of locations north of the county. It should be noted however, that the regional system is designed to supplement Miami-Dade's well fields not replace them. Over pumping the well fields in time of drought may lead to salt water intrusion and a permanent compromise of Miami-Dade's potable water supply. South Florida Water Management has constructed levees to aid in the

protection of the county's well fields from saltwater intrusion.

H. WATER SHORTAGE/DROUGHT					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
12+ Hours	• Drought	• Disrupted Commercial Services • Disrupted Government Services • Psychological Hardship	• Sewer System Loss or Disruption • Water System Loss or Disruption	Business Interruptions: • Temporary Loss of Capital Stock, Loss of Tax Base Unemployment: • Short Term	• Damage to Critical Environmental Resources

TECHNOLOGICAL.

I. COMMUNICATION FAILURE.

Loss of communication system(s). Commonly, communication failures occur due to power outages.

I. COMMUNICATION FAILURE					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
Minimal-No	• Other	• Disrupted Commercial Services • Disrupted Government Services • Psychological Hardship	• Telecommunications System Loss or Disruption	Business Interruptions: • Temporary	• Other

J. FIRE, EXPLOSION/ STRUCTURAL.

In terms of average annual loss of life and property, structural fires - often referred to as the "universal hazard" because they occur in virtually every community - are by far one of the common hazards facing Key Biscayne. Structural fires are divided into several categories: public assembly property, educational property, institutional, store/office, basic industry, utility defense, manufacturing, storage, special, residential, and unclassified. The majority of fires, which are dealt with on an annual basis by the fire department, are relatively small and most of the stations are able to handle the fires they respond to with minimal assistance from outside mutual aid. Real problems could arise however if a fire in multiple tenet dwellings. A significant structural fire could occur anytime.

J. FIRE, EXPLOSION/STRUCTURAL.

Warning Time	Primary Effects of Hazard	Impacts on People	Impacts on Property/Facilities/ Infrastructure	Impacts on Economy	Impacts on Environment
Minimal-No	• Explosion • Fire • Toxic Release/Hazardous Substance Spill	• Air Quality • Debris in Streets • Disrupted Commercial Services • Disrupted Government Services • Displaced Populations • Downed Power Lines • Entrapment • Human Safety • Isolated Areas • Mass Casualties • Multiple Deaths • Psychological Hardship • Stranded	• Air Transportation Disruption • Bridges/Roads • Building/Structure Collapse • Damaged Buildings-Commercial • Damaged Buildings-Public (Critical Facilities) • Damaged Buildings-Public (Essential Services) • Damaged Buildings-Public (General Use) • Damaged Buildings-Residential • Damage to Identified Historical/Cultural Resources • Electric Power Outage • Media (Radio/TV/Print) Loss or Disruption • Petroleum Products (Gas/Oil) Loss or Disruption • Pipeline Systems Loss or Disruption • Sewer System Loss or Disruption • Storm Water Drainage Impairment • Surface (Road/Rail) Transportation Loss or Disruption • Telecommunications System Loss or Disruption • Water System Loss or Disruption	Business Interruptions: • Permanent • Temporary Loss of Capital Stock, Loss of Tax Base Unemployment: • Long Term • Short Term	• Air Pollution • Damage to Critical Environmental Resources

K. FUEL/RESOURCE SHORTAGE.

An fuel/resource crisis is any great shortfall (or price rise) in the supply of energy resources to an economy. It usually refers to the shortage of oil and additionally to electricity or other natural resources. The crisis often has effects on the rest of the economy, with many recessions being caused by an energy crisis in some form. In particular, the production costs of electricity rise, which raises manufacturing costs.

For the consumer, the price of gasoline (petrol) and diesel for cars and other vehicles rises, leading to reduced consumer confidence and spending, higher transportation costs and general price rises.

K. FUEL/RESOURCE SHORTAGE					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
12 Hours +	• Other	• Disrupted Commercial Services • Disrupted Government Services • Stranded	• Petroleum Products (Gas/Oil) Loss or Disruption • Pipeline Systems Loss or Disruption	Business Interruptions: • Temporary Loss of Capital Stock, Loss of Tax Base Unemployment: • Short Term	• Other

L. POWER/UTILITY FAILURE OUTAGE.

In Key Biscayne the major causes of a power failure are lightning and trees. Lightning strikes and trees falling onto power lines can shut down power for hundreds of people. Other factors that can cause a power failure are: Age of facility (transmission and distribution); Community growth; and High winds.

L. POWER/UTILITY FAILURE OUTAGE.					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
Minimal-No	• Other	• Air Quality • Disrupted Commercial Services • Disrupted Government Services • Displaced Populations • Human Safety • Mass Casualties • Multiple Deaths • Psychological Hardship	• Electric Power Outage • Media (Radio/TV/Print) Loss or Disruption • Petroleum Products (Gas/Oil) Loss or Disruption • Pipeline Systems Loss or Disruption • Sewer System Loss or Disruption • Storm Water Drainage Impairment • Surface (Road/Rail) Transportation Loss or Disruption • Telecommunications System Loss or Disruption • Water System Loss or Disruption	Business Interruptions: • Temporary Unemployment: • Short Term	• Other

M. RADIOLOGICAL, FIXED FACILITY.

The Village of Key Biscayne and surrounding municipalities are located within the Emergency Planning Zone (EPZ) of the Turkey Point Nuclear Power Plant, located in the southeastern portion of Miami-Dade County.

While an actual release of radioactive material is extremely unlikely and the immediate threat to life extremely low, vulnerability to a nuclear plant disaster could consist of long range health effects with temporary and permanent displacement of population from affected areas.

M. RADIOLOGICAL, FIXED FACILITY					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
Minimal-No	• Toxic Release/Hazardous Substance Spill • Other	• Air Quality • Disrupted Commercial Services • Disrupted Government Services • Displaced Populations • Health/Epidemic • Human Safety • Mass Casualties • Multiple Deaths • Psychological Hardship	• Air Transportation Disruption • Damaged Buildings-Commercial • Damaged Buildings-Public (Critical Facilities) • Damaged Buildings-Public (Essential Services) • Damaged Buildings-Public (General Use) • Damaged Buildings-Residential • Damage to Identified Historical/Cultural Resources	Business Interruptions: • Permanent • Temporary Loss of Capital Stock, Loss of Tax Base Unemployment: • Long Term • Short Term	• Air Pollution • Damage to Critical Environmental Resources • Soil Contamination • Water Pollution

N. TRANSPORTATION ACCIDENT: AIRCRAFT, MARINE, MOTOR VEHICLE.

Miami International Airport is a major commercial air transportation hub, with extensive commercial passenger and freight business as well as a significant amount of private or general aviation activity as well. Some runway approaches pass directly over the Village. Aviation is an important element of the economy and this activity raises the Village's vulnerability to aviation associated accidents.

Vulnerability to transportation system accidents is also associated with the highway and rail systems that run through the Village. Individual population center vulnerabilities to this hazard are entirely dependent upon location.

N. TRANSPORTATION ACCIDENT: AIRCRAFT, MARINE, MOTOR VEHICLE					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
Minimal-No	• Explosion • Fire • Toxic Release/ Hazardous Substance Spill • Other	• Debris in Streets • Disrupted Commercial Services • Disrupted Government Services • Displaced Populations • Downed Power Lines	• Air Transportation Disruption • Bridges/Roads • Building/Structure Collapse • Damaged Buildings-Commercial • Damaged Buildings-Public (Critical Facilities)	Business Interruptions: • Temporary Loss of Capital Stock, Loss of Tax Base Unemployment: • Short Term	• Damage to Critical Environmental Resources • Fire • Soil Contamination • Water Pollution

N. TRANSPORTATION ACCIDENT: AIRCRAFT, MARINE, MOTOR VEHICLE					
		• Entrapment • Human Safety • Mass Casualties • Multiple Deaths • Psychological Hardship • Stranded	• Damaged Buildings-Public (Essential Services) • Damaged Buildings-Public (General Use) • Damaged Buildings-Residential • Damage to Identified Historical/Cultural Resources • Electric Power Outage • Navigable Waterway Impairment • Surface (Road/Rail) Transportation Loss or Disruption		

HUMAN/SOCIETAL.

O. CIVIL DISTURBANCE: DEMONSTRATION/ILLEGAL ASSEMBLY.

Civil disturbance is any incident, the intent of which is to disrupt a community to the degree that police intervention is required to maintain public safety. As in any other area, Key Biscayne is subject to civil disturbances in the form of riots, mob violence, and a breakdown of law and order in a focalized area. Although they can occur at any time, civil disturbances are often preceded by periods of increased tension caused by questionable social and/or political events such as controversial jury trials or law enforcement actions.

O. CIVIL DISTURBANCE					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
Minimal-No	• Explosion • Fire • Toxic Release/ Hazardous Substance Spill • Other	• Debris in Streets • Disrupted Commercial Services • Disrupted Government Services • Displaced Populations • Human Safety • Mass Casualties • Multiple Deaths • Psychological Hardship	• Bridges/Roads • Damaged Buildings-Commercial • Damaged Buildings-Public (Critical Facilities) • Damaged Buildings-Public (Essential Services) • Damaged Buildings-Public (General Use) • Damaged Buildings-Residential • Damage to Identified Historical/Cultural Resources • Electric Power	Business Interruptions: • Temporary Loss of Capital Stock, Loss of Tax Base Unemployment: • Long Term	• Damage to Critical Environmental Resources • Fire

O. CIVIL DISTURBANCE					
			• Outage • Navigable Waterway Impairment • Pipeline Systems Loss or Disruption • Surface (Road/Rail) Transportation Loss or Disruption		

P. MASS IMMIGRATION.

Florida's location as the nearest United States land mass bordering the Caribbean basin makes it a chosen point of entry for many migrants attempting to enter the country illegally. A major consequence of a mass arrival of illegal entrants could be disruptive to the routine functioning of the impacted community, resulting in significant expenditures that are related to the situation. A large uncontrolled influx of immigrants has the potential to alter the area's social and economic fabric and overwhelm the delivery of essential services such as medical and public safety. Mass immigration events are typically preceded by periods of increasing tension abroad, which can be detected and monitored. Enforcement of immigration laws is a federal responsibility. However, it is anticipated that joint jurisdictional support of any operation will be required from the state and local governments. The Village has both the history and potential for the unannounced arrival of a large number of aliens.

P. MASS IMMIGRATION					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
12+ Hours	• Other	• Disrupted Commercial Services • Disrupted Government Services • Displaced Populations • Human Safety • Psychological Hardship	• Other	Business Interruptions: • Temporary Unemployment: • Short Term	• Other

Q. POLITICAL UNREST.

Any public disturbance involving acts of violence by a group of three or more persons causing immediate danger, damage, or injury to the property or person of another individual.

Q. POLITICAL UNREST.					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
• Minimal - None	• Explosion • Fire	• Debris in Streets • Disrupted	• Bridges/Roads • Damaged	Business Interruptions:	• Damage to Critical Environmental

Q. POLITICAL UNREST.					
	• Toxic Release/Hazardous Substance Spill • Other	Commercial Services • Disrupted Government Services • Displaced Populations • Human Safety • Psychological Hardship	Buildings-Commercial • Damaged Buildings-Public (Critical Facilities) • Damaged Buildings-Public (Essential Services) • Damaged Buildings-Public (General Use) • Damaged Buildings-Residential • Damage to Identified Historical/Cultural Resources • Electric Power Outage • Surface (Road/Rail) Transportation Loss or Disruption	• Temporary Loss of Capital Stock, Loss of Tax Base Unemployment: • Short Term	Resources • Fire

R. TERRORISM: EXPLOSION AND WMD - BIOLOGICAL, CHEMICAL, NUCLEAR.

The FBI defines terrorism as, "the unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or societal objectives." A terrorist incident could involve the use of a Weapon of Mass Destruction (WMD) that would threaten lives, property and environmental resources by using explosives or incendiary devices and/or by contamination with chemical, biological, and/or radiological materials. Key Biscayne is not immune from acts of terrorism.

Due to proximity to Latin America, Cuba, and other Caribbean nations, Key Biscayne is particularly vulnerable to acts of international terrorism, which increases the likelihood of mass casualty and mass evacuation from a target area.

The ever-increasing technical capabilities of terrorist groups inevitably increases the probability of the illicit production of weapons of mass destruction. The possibility that a terrorist group could obtain weapons of this nature possesses a serious planning concern.

R. TERRORISM: EXPLOSION AND WMD - BIOLOGICAL, CHEMICAL, NUCLEAR.					
Warning Time	**Primary Effects of Hazard**	**Impacts on People**	**Impacts on Property/Facilities/ Infrastructure**	**Impacts on Economy**	**Impacts on Environment**
Minimal-No	• Explosion • Fire • Toxic Release/ Hazardous Substance Spill • Other	• Air Quality • Debris in Streets • Disrupted Commercial Services • Disrupted Government Services • Displaced Populations • Downed Power	• Air Transportation Disruption • Bridges/Roads • Building/Structure Collapse • Damaged Buildings-Commercial • Damaged Buildings-Public (Critical Facilities)	Business Interruptions: • Permanent • Temporary Loss of Capital Stock, Loss of Tax Base Unemployment: • Long Term	• Air Pollution • Damage to Critical Environmental Resources • Fire • Soil Contamination • Water Pollution

R. TERRORISM: EXPLOSION AND WMD - BIOLOGICAL, CHEMICAL, NUCLEAR.					
		• Lines • Entrapment • Health/Epidemic • Human Safety • Isolated Areas • Mass Casualties • Multiple Deaths • Psychological Hardship • Stranded	• Damaged Buildings-Public (Essential Services) • Damaged Buildings-Public (General Use) • Damaged Buildings-Residential • Damage to Identified Historical/Cultural Resources • Electric Power Outage • Media (Radio/TV/Print) Loss or Disruption • Navigable Waterway Impairment • Petroleum Products (Gas/Oil) Loss or Disruption • Pipeline Systems Loss or Disruption • Sewer System Loss or Disruption • Storm Water Drainage Impairment • Surface (Road/Rail) Transportation Loss or Disruption • Telecommunications System Loss or Disruption • Water System Loss or Disruption	• Short Term	

Chapter 1

Jurisdictional Data

Jurisdictional Data for the Village of Key Biscayne combines three elements, general information, demographics and economics, to produce the summary profile contained in this chapter.

Jurisdictional data is necessary for determining:

- Population at risk.
- Scope of potential damages.
- Disaster impacts on the local economy.

A. VILLAGE OF KEY BISCAYNE GENERAL INFORMATION

The barrier island of Key Biscayne occupies a privileged location, nestled between the beaches of the Atlantic Ocean and the waters of Biscayne Bay.

Only a causeway away from the bustle of downtown Miami, Key Biscayne is a world of its own. It's a cosmopolitan community where the sounds of languages from throughout the world mingle together in one voice of love for the Island Paradise that its residents call home.

Since the island incorporated in 1991, the Village Council has taken steps to assure that in the years to come the island maintains the quality of life that is so important to its residents. Shortly after incorporation, the first elected Council took the farsighted step to buy 10 undeveloped acres of land in the middle of the Village, assuring that residents for years to come would have a Village Green where they could enjoy sports, recreation or solitude.

Although Key Biscayne is certainly one of the most beautiful locations in South Florida, the Village Council never rests in its goal to continue beautifying public areas; planting trees and flowers and providing mini-parks throughout the Key.

People come to Key Biscayne because of the respect that people have for each other, the way people are left alone to live their lives in this small spot of paradise.

This quiet community, with a size of just less than one and a half square miles, is known for its island lifestyle just 10 minutes from downtown Miami.

Home to the NASDAQ-100 tennis open and Royal Caribbean Golf Classic, the village has The Ritz-Carlton its only hotel where visitors can enjoy the beach.

Key Biscayne, which also boasts five parks, has a volunteer recreation department, run mostly by parents within the town. The new $10 million recreation center offers sports such as sailing, basketball, baseball, tennis and soccer. Also new is the police and emergency services building, which opened in November 2002.

There are no movie theaters and hardly any fast food restaurants within the village. A small shopping district in the center of town consists of mostly independent shops, along with one major grocery store.

Density is a problem, however, for the residential community. The village government says the area is completely built out, and to maintain a high standard of living, future residential development is on hold.

(Information provided by the Chamber of Commerce)

B. DEMOGRAPHICS

Resident Population Characteristics (2000 Census).

Population:		10,507
	Male	46.9 %
	Female	53.1 %
Ethnic Groups:	White	48.1 %
	African American	0.46 %
	Hispanic	49.8 %
	Other	1.64 %
Age Distribution:	1-18	24.2 %
	19-44	34.2 %
	45-64	26.0 %
	65 +	15.6 %
Median Age:	40.1	

Miscellaneous Statistical Information.

General:	Date of Incorporation:	1991
	Form of Government:	Council-Manager
	Area Square Miles:	1.4
	Number of Fire Stations:	1
	Average January Temperature:	67 degrees
	Average July Temperature:	83 degrees
	Annual Rainfall:	56.1 inches
Other:	Percent High School Graduate +:	95.0 %
	Percent Bachelors' Degree or Higher	64.9 %

C. ECONOMIC PROFILE

Employment By Sectors:	Retail Trade	6.9 %	Finance, Insurance & Real Estate	22.7 %
	Educational	14.1 %	Manufacturing	4.2 %
	Professional	19.8 %	Transportation & Public Utilities	.4 %
	Construction	1.9 %	Agriculture, Forestry & Fishing	.4 %

Class of Worker:	Private Wage	82.1 %
	Government	8.7 %
Total Households:	6318	
Median Household Income:	86,599	
Median Family Income:	107,610	
Household Size:	2.47	
Median Home Value:	615,500	
Major Employers:	The Ritz-Carlton Village Government Larger Island Condominium Communities Winn Dixie	

Chapter 2

Hazard Identification-Population At Risk

The Village of Key Biscayne is vulnerable to a variety of hazards. They range from natural, technological, to human/societal disorder. Determining the extent of these hazards and population at risk involves a multiple step process. The process includes identifying the hazards; the frequency of the hazard; population seriously affected; duration of impact; severity; threat predictability; and effects reduction. Table 2-2 provides the "Definitions" for the data entered on Form 2: Population at Risk.

Village of Key Biscayne Hazards of Concern

Natural	Technological	Human/Societal
• Epidemic, Human • Flood, Coastal/Intercoastal • Hurricane (Cat 1)/Tropical Storm (74-95 mph) • Hurricane, Category 2, 3, 4 and 5 • Storm, Lightning/Thunder • Storm, Surge • Tornado • Water Shortage	• Communications Failure • Fire, Explosion/Structural • Fuel/Resource Shortage • Power/Utility Outage • Radiological, Fixed Facility • Transportation Accident: Aircraft, Marine and Motor Vehicle	• Civil Disturbance: Demonstration/Illegal Assembly • Mass Immigration • Political Unrest • Terrorism: Explosion • Terrorism, WMD: Biological, Chemical, Nuclear

Table 2-1
Hazards Affecting the Village of Key Biscayne

DEFINITIONS FOR COMPLETING FORM "POPULATION AT RISK"

Frequency of the Hazard.

Identifies how often the hazard has occurred in the jurisdiction. It will also assist in identifying the priority for training and mitigation activities. The choices are:

High:	At least one occurrence every 1 - 4 years.
Medium:	At least one occurrence every 5 - 10 years.
Low:	At least one occurrence every 11 - 100 years.
N/O:	Has not occurred, but for planning purposes should be evaluated as part of jurisdictions HVA.

Population Seriously Affected.

A numerical figure or percent that indicates the number of people that could be affected should the hazard occur. This information will assist in determining the number of resources and equipment that could be needed should the hazard occur.

Duration of Impact.

A number on a scale of 1 to 5 that best identifies the Long-term vs. Short-term impact to people, and property. This information will assist in determining the recovery period and the need for resources and equipment should the hazard occur. (1 = Less than 3 days or 72 hours; 2 = 3-7 days; 3 = 8 days to 1 month; 4 = 2-12 months; 5 = Over 1 year.)

Severity.

1 = Catastrophic:	More than 50 deaths/injuries; Complete shutdown of critical facilities for 30 days or more; More than 50% property damage; Severe long-term effects on economy; Severe effects on ecological systems; Severely affects state/local/private sectors capabilities to begin or sustain recovery activities; Overwhelms local and state response resources.
2 = Critical:	10-50 deaths/injuries; Shutdown of critical facilities for 8-30 days; 25-50% property damage; Short-term effect on economy; Temporarily (24-48 hours) overwhelms response resources.
3 = Limited:	Less than 10 deaths/injuries; Shutdown of critical facilities for 3-7 days; 10-25% property damage; Temporary effect on economy; No effect on response system.
4 = Negligible:	Minor injuries, no deaths; Shutdown of critical facilities for less than 3 days; Less than 10% property damage; No effect on economy; No effect on response system.

Threat Predictability.

Indicates if the hazard is a high predictability: >50%; low predictability: <50%. Determined on the basis of observation, experience, or scientific reason/documentation. This information will assist in identifying what the projected results may be to the different categories after the hazard has occurred. It will also assist in determining the affect on the tax base and the environment for the jurisdiction.

Effects Reduction.

Indicates if the hazard affects can be minimized by implementing land use ordinances, traffic re-routing, flood plain management, etc. This information will assist in determining if changes/additions need to be made, by the direction of the voting government body, before a hazard occurs. It will also assist in determining a mitigation strategy for the jurisdiction.

Table 2-2
Definitions For Completing Form "Population At Risk"

Form 2

Village of Key Biscayne Population at Risk												
Hazard	Frequency				Population Seriously Affected	Duration of Impact	Severity	Threat Predictable		Effects Reduction	
	N/O	LOW	MEDIUM	HIGH	Numeric Figure or Percent	High 5 / Low 1	1=Catastrophic 2=Critical 3=Limited 4=Negligible	HIGH	LOW	HIGH	LOW
Natural											
Epidemic, Human		X			100%	4	2	X		X	
Flood, Coastal/ Intercoastal			X		100%	2	2	X		X	
Hurricane (Cat 1)/Tropical Storm (74-95 mph)			X		100%	5	3	X		X	
Hurricane, Cat 2			X		100%	5	2	X		X	
Hurricane, Cat 3			X		100%	5	2	X		X	
Hurricane, Cat 4		X			100%	5	1	X		X	
Hurricane, Cat 5		X			100%	5	1	X		X	
Storm, Lightning/ Thunder				X	100%	5	4	X		X	
Storm, Surge		X			100%	5	2	X		X	
Tornado		X			100%	5	2		X	X	
Water Shortage		X			100%	3	3	X		X	
Technological											
Communications Failure	X				100%	1	3		X	X	
Fire, Explosion/ Structural				X	100%	2	2		X	X	
Fuel/Resource Shortage		X			100%	4	3	X		X	
Power/Utility Outage			X		100%	3	3		X	X	
Radiological, Fixed Facility	X				100%	5	1		X		X
Transportation Accident: Aircraft, Marine and Motor Vehicle				X	5%	1	3		X	X	
Human/Societal											
Civil Disturbance: Demonstration/Illegal Assembly		X			100%	1	3		X		
Mass Immigration		X			100%	3	2		X		
Political Unrest	X				100%	2	3		X		
Terrorism: Explosion	X				100%	3	2		X		
Terrorism, WMD: Biological, Chemical, Nuclear	X				100%	4	2		X		

Blank Intentionally

Chapter 3

Risk Calendar & Risk Maps

Different hazards have different effects on the ability to effectively respond to a hazard and continue to direct, control, manage, and coordinate emergency operations within the Village and in cooperation with other responding organizations. Identifying hazards should be accompanied by visual information. It is advisable to develop a comprehensive risk map and calendar which visually depicts the total emergency/disaster potential for the Village of Key Biscayne. The benefits of a Risk Calendar and Risk Maps are listed in Table 3-1.

Benefits of a Risk Calendar & Risk Maps

- Identifies potential high hazard areas;
- Provides the basis for resource allocation and backup support;
- Identifies potential high activity seasons for specific hazards; and,
- Identifies the geographic need and time for public education and information.

Table 3-1
Benefits of Risk Calendar & Risk Maps

RISK CALENDAR.

The Risk Calendar identifies the months and the time of the year (months) that the particular hazard has the greatest chance of occurring in Village of Key Biscayne. Form 3: Risk Calendar is on the following page.

RISK MAPS.

See Table 3-3: Village of Key Biscayne Inventory of Supporting GIS Maps, Table 3-4: Map Overlay & Data Available from Village of Key Biscayne GIS Division, and Table 3-5: Desired Risk Maps provide information about the status of mapping.

Form 3

Village of Key Biscayne Risk Calendar												
Hazard	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Natural												
Epidemic, Human												
Flood, Coastal/Intercoastal												
Hurricane (Cat 1)/Tropical Storm (74-95 mph)												
Hurricane, Category 2, 3, 4 and 5												
Storm, Lightning/Thunder												
Storm, Surge												
Tornado												
Water Shortage												
Technological												
Communications Failure												
Fire, Explosion/Structural												
Fuel/Resource Shortage												
Power/Utility Outage												
Radiological, Fixed Facility												
Transportation Accident: Aircraft, Marine and Motor Vehicle												
Human/Societal												
Civil Disturbance: Demonstration/ Illegal Assembly												
Mass Immigration												
Political Unrest												
Terrorism: Explosion												
Terrorism, WMD: Biological, Chemical, Nuclear												

Village of Key Biscayne Inventory of Supporting GIS Maps			
Hazard	**Map(s) Available for this Hazard**	**Source**	**Scale of Map**
Natural			
Epidemic, Human	No		
Flood, Coastal/Intercoastal	Yes	M-D County, State, Federal	
Hurricane (Cat 1)/Tropical Storm (74-95 mph)	No		
Hurricane, Category 2, 3, 4 and 5	No		
Storm, Lightning/Thunder	No		
Storm, Surge	No		
Tornado	No		
Water Shortage	No		
Technological			
Communications Failure	No		
Fire, Explosion/Structural	No		
Fuel/Resource Shortage	No		
Power/Utility Outage	No		
Radiological, Fixed Facility	Yes	State	
Transportation Accident: Aircraft, Marine and Motor Vehicle	No		
Human/Societal			
Civil Disturbance: Demonstration/Illegal Assembly	No		
Mass Immigration	No		
Political Unrest	No		
Terrorism: Explosion	No		
Terrorism, WMD: Biological, Chemical, Nuclear	No		

Available From:
M-DC = Miami-Dade County.
FED = Available from a federal agency (see "Sources of Supporting GIS Maps" On the following page.

Table 3-3
Village of Key Biscayne Inventory of Supporting GIS Maps

MAP OVERLAY & DATA AVAILABLE FROM VILLAGE OF KEY BISCAYNE

General Base Layers
Single Line Street Network
Property Ownership (folios)
Annotation
Coast Line
Municipal Boundary
Aerials1998 - one ft resol.
Aerials Downtown - half ft resol.

Land Development
Future Land Use
Existing Land Use 2000
Land Development Zoning
Neighborhoods

Political
Voting Precincts
Polling Locations
Commission Districts
Zip Code

Solid Waste
Solid Waste Inspection Routes
Garbage Routes

Public Works
Storm Water

Census
Census Tracts 2000
Census Block Groups 2000
Census Blocks 2000

Public Safety
Fire Stations
Police Stations
Police Reporting Areas
Public Facilities

Miscellaneous
Parks

Table 3-4
Map Overlay & Data Available From Village of Key Biscayne GIS Division

Desired Risk Maps

- Comprehensive land use map
- Comprehensive zoning map
- Vicinity map of jurisdiction showing neighborhoods, commercial areas, public gathering places, and streets
- Contour map (25' if possible)
- Environmental sensitive area map showing landslides, seismic hazard, and streets
- Fire response map showing stations, shoreline, and streets
- Stream, flood plains, and wetlands map
- Dams (federal, state, local and private), particularly dams upstream from population centers
- Hurricane, tornado and other wind storm "alleys"
- Erosion hazard map
- Environmental sensitive area map showing drainage basins, and streams
- Vicinity map showing major transportation routes
- Transportation system: airports, railroads, highways, waterways, pipelines.
- Water utility map
- Surface water utility map
- Sewer utility map
- Fiber optic map
- Gas utility map
- Electric utility map
- Fuel facilities map: chemical/petroleum
- Extremely Hazardous Substance (EHS) sites map
- Wildfire maps

Table 3-5
Desired Risk Maps

Sources of Supporting GIS Maps	
A. NATIONAL	
Floods	
FEMA Flood Insurance Rate Maps (FIRM)	http://msc.fema.gov/MSC/statemap.htm http://.fema.gov/maps/
Guide to Flood Maps on the Web	http://www.fema.gov/nfip/readmap.htm
Earthquakes	geohazards.cr.usgs.gov/eq/pubmaps/US.pga.050.map.gif
Tsunamis	http://www.pmel.noaa.gov/~bernard/senatec.html
Tornadoes	http://www.fema.gov/mit/bpat/bpn_tsfs.htm
ASCE Wind Speed Maps	http://www.ascepub.infor.com/windload.html
Coastal Storms	http://www.aoml.noaa.gov/hrd/tcfaq/tcfaqG.html#G12
Landslides	http://landslides.usgs.gov/html_files/landslides/nationalmap/national.html
Wildfires	http://www.fs.fed.us/land/wfas/fd_class.gif
Volcano	http://volcanoes.usgs.gov
General Sources	http://www.esri.com/hazards
USGS National Mapping Information: Elevation, hydrology, land use, transportation, etc.	http://www.usgs.gov
FEMA Map Service Center	http://.fema.gov/maps/
HAZUS	http://www.fema.fema.gov/hazus/
Natural Hazards Statistics	http://www.noaa.gov/om/hazstats.htm
Disaster Center	http://www.disastercenter.com

Sources of Supporting GIS Maps	
B. STATE	Florida Division of Emergency Management
C. LOCAL	City of Miami GIS
	Miami-Dade Office of Emergency Management: www.co.miami-dade.fl.us

Table 3-6
Sources of Supporting GIS Maps

Chapter 4

Primary Effects of Hazards

This portion of the assessment identifies the primary effects of the hazards. Primary effects are defined as major consequences that are likely to occur from the hazard. As an example: A hurricane occurs. The primary effects of the hurricane would be high winds and storm surge.

Hazards for the Village of Key Biscayne (as identified in Chapter 2) are listed below. To expand on the hazard vulnerability assessment the list of Primary Effects for the Village of Key Biscayne are added to the process and are listed in Table 4-1 below. The listing of "Primary Effects" conforms with federal guidelines for hazard assessments.

Form 4: Primary Effects, illustrates hazards and the primary effects the hazard will produce. An estimate of "warning time" for each hazard is also indicated.

Review of Hazard Identification-Population at Risk from Chapter 2

Natural	Technological	Human/Societal
Epidemic, Human	Communication Failure	Civil Disturbance: Demonstration/ Illegal Assembly
Flood, Coastal/ Intercoastal	Fire: Explosion/ Structural	Mass Immigration
Hurricane (Cat 1)/Tropical Storm (74-95)	Fuel/Resource Shortage	Political Unrest
Hurricane Cat 2	Power Failure (Outage)	Terrorism: Explosion
Hurricane Cat 3	Radiological, Fixed Facility	Terrorism, WMD: Biological, Chemical, Nuclear
Hurricane Cat 4	Transportation Accident Aircraft, Marine, and Motor Vehicle	
Hurricane Cat 5		
Storm, Lighting/Thunder		
Tornado		
Water Shortage		

Primary Effects of Hazards		
Damaging Hail	Fire	Snow
Drought	Ground Displacement/Shaking	Subsidence (sink holes)
Extreme Cold/Freeze	High Wind/Excessive Wind	Tidal Waves/Tidal surge
Extreme Heat	Ice	Tsunami/Seiche
Fast Moving Water	Landslides	Toxic Release/Hazardous Substance Spill
Excessive Water (flooding)	Mud/Debris	Other:
Explosion	Flow/Avalanche Soil/Beach Erosion (wind, water)	

Table 4-1
Primary Effects of Hazards

Remember:

- Hazards cause "effects."
- Effects result in "impacts/consequences."
- Mitigation strategies are based on the probable impacts.

Form 4

Primary Effects of Hazards

Hazard	Warning Time 1 = Minimal-No 2 = 3-6 Hours 3 = 6-12 Hours 4 = 12+ Hours	Damaging Hail	Drought	Extreme Cold/Freeze	Extreme Heat	Fast Moving Water	Excessive Water (Flooding)	Explosion	Fire	Ground Displacement	High Wind/Excessive Wind	Ice	Landslides	Mud/Debris Flow/Avalanche	Soil Beach Erosion (Wind, Water)	Snow	Subsidence (Sink Holes)	Tidal Waves/Tidal Surge	Tsunami/Seiche	Toxic Release/Hazardous Substance Spill	Other
Natural																					
Epidemic, Human	4																				X
Flood, Coastal/ Intercoastal	2					X	X			X					X			X	X		
Hurricane (Cat 1)/ Tropical Storm (74-95 mph)	4					X	X				X				X			X			
Hurricane, Cat 2	3					X	X				X				X			X			
Hurricane, Cat 3	3					X	X				X				X			X			
Hurricane, Cat 4	2					X	X				X				X			X			
Hurricane, Cat 5	2					X	X				X				X			X			
Storm, Lightning/ Thunder	1	X					X				X										
Storm Surge						X	X								X			X			
Tornado	1	X									X										
Water Shortage	4		X																		
Technological																					
Communications Failure	1																				X
Fire, Explo-sion/Structural	1							X	X											X	
Fuel/Resource Shortage	4																				X
Power/Utility Outage	1																				X
Radiological, Fixed Facility	1																			X	X
Transportation Accident: Aircraft, Marine and Motor Vehicle	1							X	X											X	X
Human/Societal																					
Civil Disturbance: Demonstration/Illegal Assembly	1							X	X											X	X
Mass Immigration	1																				X
Political Unrest	1							X	X											X	X
Terrorism: Explosion	1							X	X											X	X
Terrorism, WMD: Biological, Chemical, Nuclear	1							X	X											X	X

Chapter 5
Probable Impacts of Hazard Effects

Impacts are defined as all the consequences of the hazard. As an example: A hurricane occurs. The effects of the hurricane are high winds and storm surge. The resulting consequences - building collapse, explosion, death, etc., are the impacts.

This Chapter identifies the probable impacts of the "Hazard Effects" on:

- Form 5A: Impacts on People
- Form 5B: Property/Facilities/Infrastructure
- Form 5C: Environment
- Form 5D: Economy

Review of Hazard Identification-Population at Risk from Chapter 2

Natural	Technological	Human/Societal
Epidemic, Human	Communication Failure	Civil Disturbance: Demonstration/ Illegal Assembly
Flood, Coastal/ Intercoastal	Fire: Explosion/ Structural	Mass Immigration
Hurricane (Cat 1)/Tropical Storm (74-95)	Fuel/Resource Shortage	Political Unrest
Hurricane Cat 2	Power Failure (Outage)	Terrorism: Explosion
Hurricane Cat 3	Radiological, Fixed Facility	Terrorism, WMD: Biological, Chemical, Nuclear
Hurricane Cat 4	Transportation Accident Aircraft, Marine, and Motor Vehicle	
Hurricane Cat 5		
Storm, Lighting/Thunder		
Tornado		
Water Shortage		

Review of Primary Effects of Hazards from Chapter 4

Damaging Hail	Fire	Snow
Drought	Ground Displacement/Shaking	Subsidence (sink holes)
Extreme Cold/Freeze	High Wind/Excessive Wind	Tidal Waves/Tidal surge
Extreme Heat	Ice	Tsunami/Seiche
Fast Moving Water	Landslides	Toxic Release/Hazardous Substance Spill
Excessive Water (flooding)	Mud/Debris	Other:
Explosion	Flow/Avalanche Soil/Beach Erosion (wind, water)	

Impacts on People	
• Air Quality • Debris in Streets • Disrupted Commercial Services • Disrupted Government Services • Displaced Populations • Downed Power Lines • Entrapment • Health/Epidemic	• Human Safety • Isolated Areas • Mass Casualties • Multiple Deaths • Psychological Hardship • Stranded Other:

Table 5-1
Impacts on People

Impacts on Property/Facilities/Infrastructure		
• Air Transportation Disruption • Agricultural/Fisheries Damage • Bridges/Roads • Building/Structure Collapse • Crops/Livestock • Dam Failure • Damaged Buildings-Commercial • Damaged Buildings-Public (Critical Facilities) • Damaged Buildings-Public (Essential Services)	• Damaged Buildings-Public (General Use) • Damaged Buildings-Residential • Damage to Identified Historical/Cultural Resources • Electric Power Outage • Media (Radio/TV/Print) Loss or Disruption • Navigable Waterway Impairment • Petroleum Products (Gas/Oil) Loss or Disruption	• Pipeline Systems Loss or Disruption • Sewer System Loss or Disruption • Storm Water Drainage Impairment • Surface (Road/Rail) Transportation Loss or Disruption • Telecommunications System Loss or Disruption • Water System Loss or Disruption Other:

Table 5-2
Impacts on Property/Facilities/Infrastructure

Impacts on Economy	
Business Interruptions: • Permanent • Temporary Loss of Capital Stock, Loss of Tax Base	Unemployment: • Long Term • Short Term Other:

Table 5-3
Impacts on Economy

Impacts on Environment	
• Air Pollution • Damage to Critical Environmental Resources • Erosion, Water/Wind • Fire	• Landslide • Soil Contamination • Water Pollution Other:

Table 5-4
Impacts on Environment

Form 5A

Impacts on People															
Primary Effects of Hazards	Air Quality	Debris in Streets	Disrupted Commercial Services	Disrupted Government Services	Displaced Populations	Downed Power Lines	Entrapment	Health/Epidemic	Human Safety	Isolated Areas	Mass Casualties	Multiple Deaths	Psychological Hardship	Stranded	Other
Natural															
Epidemic, Human			X	X				X	X	X	X	X	X		
Flood, Coastal/Intercoastal		X	X	X	X				X	X	X	X	X	X	
Hurricane (Cat 1)/Tropical Storm (74-95 mph)		X	X	X	X	X			X	X		X	X	X	
Hurricane, Cat 2		X	X	X	X	X	X	X	X	X		X	X	X	
Hurricane, Cat 3		X	X	X	X	X	X	X	X	X		X	X	X	
Hurricane, Cat 4		X	X	X	X	X	X	X	X	X	X	X	X	X	
Hurricane, Cat 5		X	X	X	X	X	X	X	X	X	X	X	X	X	
Storm, Lightning/Thunder		X	X	X		X			X	X	X				
Storm, Surge		X	X	X	X				X	X					
Tornado		X	X	X	X	X	X	X	X	X	X	X	X	X	
Water Shortage			X	X				X	X				X		
Technological															
Communications Failure			X	X					X				X		
Fire, Explosion/Structural	X	X	X	X	X	X	X		X	X	X	X	X	X	
Fuel/Resource Shortage			X	X										X	
Power/Utility Outage	X		X	X	X				X		X	X	X		
Radiological, Fixed Facility	X		X	X	X			X	X		X	X	X		
Transportation Accident: Aircraft, Marine and Motor Vehicle		X	X	X	X	X	X		X		X	X	X	X	
Human/Societal															
Civil Disturbance: Demonstration/Illegal Assembly		X	X	X	X				X		X	X	X		
Mass Immigration			X	X	X				X				X		
Political Unrest		X	X	X	X				X	X	X	X	X	X	
Terrorism: Explosion		X	X	X	X	X	X	X	X	X	X	X	X	X	
Terrorism, WMD: Biological, Chemical, Nuclear	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

Form 5B

Impacts on Property/Facilities/Infrastructure																							
Hazards	Air Transportation Disruption	Agricultural/Fisheries Damaged	Bridges/Roads	Building/Structure Collapse	Crops/Livestock	Dam Failure	Damaged Bldgs: Commercial	Dam'gd Bldgs: Public-Critical Facilities	Dam'gd Bldgs: Public-Essential Services	Dam'gd Bldgs: Public-General Use	Dam'gd Bldgs: Residential	Damage to Historical/Cultural Resources	Electrical Power Outage	Media: Radio/TV/Print-Loss/Disruption	Navigable Waterway Impairment	Petroleum Products: Gas/Oil- Loss/Disruption	Pipeline Systems Loss/Disruption	Sewer System Loss/Disruption	Storm Water Drainage Impairment	Surface (Road/Rail) Transportation	Telecommunications System Loss/Disruption	Water System Loss/Disruption	Other
Natural																							
Epidemic, Human	X																						
Flood, Coastal/ Intercoastal			X				X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
Hurricane (Cat 1) /Tropical Storm (74-95 mph)	X		X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Hurricane, Cat 2	X		X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Hurricane, Cat 3	X		X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Hurricane, Cat 4	X		X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Hurricane, Cat 5	X		X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Storm, Lightning/ Thunder							X	X	X	X	X		X	X				X	X		X	X	
Storm, Surge			X	X			X	X	X	X	X	X	X			X	X	X	X	X		X	
Tornado			X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Water Shortage																		X				X	
Technological																							
Communications Failure																					X		
Fire, Explosion/ Structural		X	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	
Fuel/Resource Shortage																X	X						
Power/Utility Outage													X	X		X	X	X	X	X	X	X	
Radiological, Fixed Facility	X						X	X	X	X	X	X											
Transportation Accident: Aircraft, Marine and Motor Vehicle	X		X	X			X	X	X	X	X	X	X		X					X			
Human/Societal																							
Civil Disturbance: Demonstration/Illegal Assembly			X				X	X	X	X	X	X	X		X		X			X			
Mass Immigration																							X
Political Unrest			X				X	X	X	X	X	X	X							X			
Terrorism: Explosion	X		X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Terrorism, WMD: Biological, Chemical, Nuclear	X		X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

Form 5C

Impacts on Environment								
Hazards	Air Pollution	Damage to Critical Environmental Resources	Erosion, Water/Wind	Fire	Landslide	Soil Contamination	Water Pollution	Other
Natural								
Epidemic, Human								X
Flood, Coastal/Intercoastal		X	X			X	X	
Hurricane (Cat 1)/Tropical Storm (74-95 mph)		X	X			X	X	
Hurricane, Cat 2		X	X			X	X	
Hurricane, Cat 3		X	X			X	X	
Hurricane, Cat 4		X	X			X	X	
Hurricane, Cat 5		X	X			X	X	
Storm, Lightning/Thunder		X		X				
Storm, Surge		X	X			X	X	
Tornado		X	X			X	X	
Water Shortage		X						
Technological								
Communications Failure								X
Fire, Explosion/Structural	X	X		X				
Fuel/Resource Shortage								X
Power/Utility Outage								X
Radiological, Fixed Facility	X	X				X	X	
Transportation Accident: Aircraft, Marine and Motor Vehicle		X		X		X	X	
Human/Societal								
Civil Disturbance: Demonstration/ Illegal Assembly		X		X				
Mass Immigration								X
Political Unrest		X		X				
Terrorism: Explosion	X	X		X		X	X	
Terrorism, WMD: Biological, Chemical, Nuclear	X	X		X		X	X	

Form 5D

Impacts on Economy							
Hazards	Business Interruptions		Unemployment		Loss of Capital Stock, Loss of Tax Base	Other
	Permanent	Temporary	Long Term	Short Term		
Natural						
Epidemic, Human		X		X		
Flood, Coastal/Intercoastal		X		X	X	
Hurricane (Cat 1)/Tropical Storm (74-95 mph)		X	X	X	X	
Hurricane, Cat 2		X	X	X	X	
Hurricane, Cat 3		X	X	X	X	
Hurricane, Cat 4	X	X	X	X	X	
Hurricane, Cat 5	X	X	X	X	X	
Storm, Lightning/Thunder		X			X	
Storm, Surge		X		X	X	
Tornado	X	X	X	X	X	
Water Shortage		X		X		
Technological						
Communications Failure		X				
Fire, Explosion/Structural	X	X	X	X	X	
Fuel/Resource Shortage		X		X		
Power/Utility Outage		X		X		
Radiological, Fixed Facility	X	X	X	X	X	
Transportation Accident: Aircraft, Marine and Motor Vehicle		X		X	X	
Human/Societal						
Civil Disturbance: Demonstration/ Illegal Assembly		X	X		X	
Mass Immigration		X		X		
Political Unrest		X		X	X	
Terrorism: Explosion	X	X	X	X	X	
Terrorism, WMD: Biological, Chemical, Nuclear	X	X	X	X	X	

Chapter 6
Mitigation

Mitigation is any activity that actually eliminates or reduces the probability of occurrence of a disaster; or activities that reduce the effects of unavoidable disasters; or eliminate or reduce the degree of long- term risk to human life and property from natural and technological hazards. Any activities that reduce the chance that lives will be lost or property destroyed can be considered mitigation.

As already indicated, hazards produce primary effects and impact on people, property/environment, and the economy. Though it may be impossible to eliminate the hazard (effects), we can lessen the potential impacts through mitigation activities.

Mitigation is a concept which includes many varied and diverse activities. They range from policy and program development, through public education and constituency building, to scientific research and structural engineering. Mitigation activities strive to balance current actions and expenditures with potential losses from future hazards (cost of activities versus future benefits).

Hazard mitigation is any action taken to permanently reduce or eliminate long-term risk to people and their property from the effects of hazards. These hazards can be of any type, whether from natural causes, such as tornados, floods, etc., from technological causes, such as hazardous chemical emergencies, or from man-made causes, such as economic crises. A community can take steps to prepare and implement mitigation techniques for almost any type of hazard that may threaten its citizens, businesses and institutions.

Hazard mitigation plans can identify a range of structural approaches to lower the costs of future disasters by meeting the unique needs of the community. Structural mitigation projects could involve modifying the current "built" environment to decrease the risk to people and property by "retrofitting" structures in existing neighborhoods. They can also be just the opposite and involve restoring the environment of hazardous areas to its original condition by removing vulnerable structures.

Mitigation strategies can also involve non-structural initiatives, such as educational programs to inform the community about the risks the public and its property face in order to encourage them to purchase insurance or retrofit their homes. Programs can also include developing and enforcing regulations to prevent construction in hazard areas, or to ensure that development that does occur will be resistant to the hazards threatening the area.

Mitigation programs and projects serve to lessen a community's vulnerability to the hardships and costs of disasters. The implementation of mitigation programs is a key component to achieving a "sustainable community," one in which people, businesses, and institutions are protected from the disruptions and impacts of emergencies and disasters. Hazard mitigation planning must be closely coordinated with a community's overall planning and development efforts intended to provide its citizens a safe, healthy and prosperous place to live and work. The most effective way for a community to achieve this objective is by developing a local hazard mitigation strategy.

Form 6: Mitigation Strategies to Reduce or Eliminate Hazard Impact is used to identify strategies to lessen/eliminate hazard impacts identified in Chapter 5: Probable Impacts of Hazards. A list of "Mitigation Strategies" is provided in Table 6-1 and on the horizontal axis of Mitigation Strategies (Form 6A). The categories of Mitigation Strategies conform with federal guidelines for Mitigation planning.

Form 6B: Mitigation Roles is used to suggest mitigation roles for Village of Key Biscayne departments and others.

Attachment 2 contains examples of possible mitigation projects and activities for each mitigation strategy. Form 6A, Form 6B, and Attachment 2 can be used as the basis for the development of a comprehensive mitigation plan for Village of Key Biscayne.

Additional Comment

Preparedness and response activities can also be considered a form of mitigation to the extent that mitigation measures cannot prevent hazard effects. If you cannot make the hazards and the effects of hazards go away, then having the capability to respond is critical. Having resources "ready to go" can be considered a form of mitigation, i.e. the quicker we apply resources to injured and/or trapped people, the greater chance that we will save lives and reduce the probability of secondary effects.

Review of Probable Impacts of Hazard Effects from Chapter 5

Impacts on People

- Air Quality
- Debris in Streets
- Disrupted Commercial Services
- Disrupted Government Services
- Displaced Populations
- Downed Power Lines
- Entrapment
- Health/Epidemic
- Human Safety
- Isolated Areas
- Mass Casualties
- Multiple Deaths
- Psychological Hardship
- Stranded

Other:

Impacts on Property/Facilities/Infrastructure

- Air Transportation Disruption
- Agricultural/Fisheries Damage
- Bridges/Roads
- Building/Structure Collapse
- Crops/Livestock
- Dam Failure
- Damaged Buildings-Commercial
- Damaged Buildings-Public (Critical Facilities)
- Damaged Buildings-Public (Essential Services)
- Damaged Buildings-Public (General Use)
- Damaged Buildings-Residential
- Damage to Identified Historical/Cultural Resources
- Electric Power Outage
- Media (Radio/TV/Print) Loss or Disruption
- Navigable Waterway Impairment
- Petroleum Products (Gas/Oil) Loss or Disruption
- Pipeline Systems Loss or Disruption
- Sewer System Loss or Disruption
- Storm Water Drainage Impairment
- Surface (Road/Rail) Transportation Loss or Disruption
- Telecommunications System Loss or Disruption
- Water System Loss or Disruption

Other:

Impacts on Economy

Business Interruptions:
- Permanent
- Temporary

Loss of Capital Stock, Loss of Tax Base

Unemployment:
- Long Term
- Short Term

Other:

Impacts on Environment

- Air Pollution
- Damage to Critical Environmental Resources
- Erosion, Water/Wind
- Fire
- Landslide
- Soil Contamination
- Water Pollution

Other:

Mitigation Strategies	
1. Community Preparedness Activities. 2. Financial and Tax Incentives. 3. Hazard Control and Protective Works. 4. Building Design, Codes, Use Regulations. 5. Insurance Programs. 6. Land Use Planning/Management: General. 7. Laws/Ordinances/Rules/ Inspections.	8. Mitigation Committee. 9. Protection, Retrofit of Infrastructure and Critical Facilities. 10. Public Awareness, Training, and Education. 11. Public Health and Emergency Medical Care, & Education. 12. Public Protection. 13. Science and Technology. 14. Other:

Table 6-1
Mitigation Strategies

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Form 6A

Mitigation Strategies to Reduce or Eliminate Hazard Impact

Numbers = Strategies (See Projects/Activities List.)

Determine the Strategies that will reduce or eliminate hazard impacts by placing an "X" in the box.

Hazard Impact	1 Community Preparedness Activities	2 Financial & Tax Incentives	3 Hazard Control & Protective Works	4 Building Design, Codes, Use Regulations	5 Insurance Programs	6 Land Use Planning/ Management	7 Laws, Ordinances, Rules, Inspection	8 Mitigation Committee	9 Protection, Retrofit Infrastructure & Critical Facilities	10 Public Awareness, Training & Education	11 Public Health, Emergency Medical Care & Education	12 Public Protection	13 Science & Technology	14 Other - Identify
Impacts on People														
Air Quality	X									X			X	
Debris in Streets	X			X		X								
Disrupted Commercial Services	X			X	X					X				
Disrupted Government Services			X	X						X	X	X		
Displaced Populations										X	X	X		
Downed Power Lines						X				X		X		
Entrapment										X	X	X		
Health/Epidemic										X		X		
Human Safety										X	X			
Isolated Areas										X	X			
Mass Casualties	X		X	X		X				X	X	X		
Multiple Deaths			X	X		X				X	X	X		
Psychological Hardship										X				
Stranded										X				
Impacts on Property/ Facilities/Infrastructure														
Air Transportation Disruption									X					
Agricultural/Fisheries Damage						X								
Bridges/Roads			X						X					
Building/Structure Collapse				X					X					
Crops/Livestock						X				X				
Dam Failure				X										
Damaged Buildings-Commercial		X		X										
Damaged Buildings-Public (Critical Facilities)				X				X	X					
Damaged Buildings-Public (Essential Services)				X				X	X					
Damaged Buildings-Public (General Use)				X										
Damaged Buildings-Residential		X		X	X	X	X			X				
Damage to Identified Historical/Cultural Resources	X					X		X						
Electric Power Outage			X						X					
Media (Radio/TV/Print) Loss or Disruption		X			X				X	X				

Form 6A

Mitigation Strategies to Reduce or Eliminate Hazard Impact

Numbers = Strategies (See Projects/Activities List.)

Determine the Strategies that will reduce or eliminate hazard impacts by placing an "X" in the box.

Hazard Impact	1 Community Preparedness Activities	2 Financial & Tax Incentives	3 Hazard Control & Protective Works	4 Building Design, Codes, Use Regulations	5 Insurance Programs	6 Land Use Planning/ Management	7 Laws, Ordinances, Rules, Inspection	8 Mitigation Committee	9 Protection, Retrofit Infrastructure & Critical Facilities	10 Public Awareness, Training & Education	11 Public Health, Emergency Medical Care & Education	12 Public Protection	13 Science & Technology	14 Other - Identify
Navigable Waterway Impairment														
Petroleum Products (Gas/Oil) Loss or Disruption			X											
Pipeline Systems Loss or Disruption			X						X					
Sewer System Loss or Disruption			X						X					
Storm Water Drainage Impairment			X						X					
Surface (Road/Rail) Transportation Loss or Disruption			X			X		X	X					
Telecommunications System Loss or Disruption	X								X	X				
Water System Loss or Disruption									X	X	X			
Impacts on Environment														
Air Pollution						X	X	X		X			X	
Damage to Critical Environmental Resources			X			X	X	X		X			X	
Erosion, Water/Wind	X		X			X								
Fire	X									X				
Landslide			X			X								
Soil Contamination										X				
Water Pollution	X									X			X	
Impacts on Economy														
Business Interruptions: • Permanent		X			X					X				
• Temporary		X			X					X				
Loss of Capital Stock, Loss of Tax Base					X									
Unemployment: • Long Term					X	X		X						
• Short Term					X									

Form 6B

Mitigation Roles

Indicate a likely Mitigation role for each Department, Agency or Organization: P=Primary S=Support

Selected Village of Key Biscayne Departments, Agencies & Organizations	1 Community Preparedness Activities	2 Financial & Tax Incentives	3 Hazard Control & Protective Works	4 Building Design, Codes, Use Regulations	5 Insurance Programs	6 Land Use Planning/ Management	7 Laws, Ordinances, Rules, Inspection	8 Mitigation Committee	9 Protection, Retrofit Infrastructure & Critical Facilities	10 Public Awareness, Training & Education	11 Public Health, Emergency Medical Care & Education	12 Public Protection	13 Science & Technology	14 Other - Identify
Village Attorney	S			S		S	S	S		S		S		
Village Manager	S								S	S			S	
Village Mayor	S						S	S	S	S				
Village Council	P	P		S	P	S	P	P		S			P	
Building, Zoning & Planning	S			P		P	S		P					
Chamber of Commerce	S									P				
Fire Rescue	S		S							S	P	S		
Parks and Recreation	S		S			S				S				
Police	S		S							S		P		
Public Works	S		P			S								

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Attachment # 1

SAMPLE LISTING OF MITIGATION PROJECTS/ ACTIVITIES FOR EACH STRATEGY ON FORM 6

1. **Community Preparedness Activities.**
   - Comprehensive emergency management plan (CEMP).
   - Post-disaster redevelopment plan.
   - Equipment acquisition.
   - Resource development.
   - Training.
     - Staff development and training.
   - Emergency response, emergency management staff attending professional training sessions:
     - Damage assessment training.
     - Computer-aided management of emergency operations.
     - Orientation to disaster assistance programs.
     - State conference training sessions.
     - Hazard specific conference training sessions.
     - Responder specific conference training sessions.
     - FEMA professional development training courses.
   - Building inspector courses, such as: hurricane/wind resistant structural design, roofing updates, wood construction, fire resistance and egress.
   - Education.
   - Damage assessment plan, program, system.
   - Debris management.
     - A plan to collect, sort, store, burn and dispose of debris.
   - Temporary housing.
   - Response/recovery evaluation (situation reporting).
   - Drills:
     - Staged mock disasters.
     - Structural fire drills.
     - Tornado drills.
     - Chemical spill drills.
     - Terrorist response.
     - Medical response.
   - Warning system tests.
   - Emergency communications tests.
   - Emergency public information tests.
   - Emergency power tests.
   - Regularly scheduled maintenance programs:
     - Storm Water drainage maintenance.
     - Removal of debris from beaches and drainage channels.
     - General litter removal.
     - Tree trimming along evacuation routes.
   - Complete a comprehensive self- assessment (program review) of the community's emergency management program.

2. **Financial and Tax Incentives.**
   - Tax incentives.
   - Insurance rebates.
   - Home mitigation retrofit grants to home owners.

- Exempt retrofit improvements from future property tax assessment increases.
- Do not charge for building permits (but issue them) relating to hazard retrofit projects.
  - Ensure that permits are easy to obtain.
- State bond issue for purchase of land adjacent to watercourses.
- Establish "hazard districts" to provide a stable funding source for hazard mitigation projects and activities.
- Implement a "storm water utility fee." Use proceeds to fund mitigation projects.
- Use of state and federal funding sources for mitigation projects and activities.
- Work with insurance companies and mortgage companies to establish lower insurance premiums for building retrofits.
- Tax benefits for demolishing damaged buildings, homes.
- Community economic development: Ensure that existing businesses and industry will want to remain in your community by protecting and enhancing infrastructure and critical facilities, e.g. transportation, water, power, etc.
- Fiscal management planning: How will costs of mitigation projects/activities be distributed among existing residents, future residents, landowners, industry, etc.?
- Provide an economic profile of the planning area including an analysis of the economic potential of high risk areas and the cost of recovering from disasters - both with, and without, existing and proposed mitigation initiatives.
- Establish rules, laws that limit public expenditures in areas identified as subject to repetitive damage from disasters.
- Obtain lower community insurance premiums through implementing outreach projects that focus on hazard mitigation issues like building construction requirements and regulations, the beneficial functions of natural systems (beaches and dunes, wetlands, floodplains), and hazard area identification.

3. Hazard Control and Protective Works.

- Floods: Flood proofing, dams, reservoirs, levees, dikes, drainage systems, flood walls, detention basins/ponds, and other storm drainage upgrades, seawalls.
- Hurricanes: Building strengthening: shutters, safe rooms
- Drought: Soil erosion controls, improved agricultural cultivation practices, water supply protection and conservation.
- Earthquake: Seismic-resistant new construction.
- Tornadoes: High wind resistant buildings.
- Avalanche: Terrain modification.
- Hazardous Materials Management.
- Landslide: Geologic engineering.
- High winds: Tree-shelter belts, wind breaks, sitting of key facilities in lee of hillsides, plant forestry areas upwind.
- General (corrective measures applied to existing development): acquisition of developed properties, relocation, redevelopment and renewal, site and building modifications.
- Beach nourishment and dune construction.
- Handbook for building and property owners containing instructions, information on hazard control and protection.
  - Training and education programs.
- Handbook for natural resource conservation agencies and organizations containing instructions, information on hazard control and protection.
  - Training and education programs.
- Structural projects (hazard control measures to keep a hazard(s) from impacting property.
- Engineering studies.
- Maintenance Programs: Storm Water drainage, tree trimming, litter removal.

4. Building Design, Codes, Use Regulations.

- Require structures to be built to withstand destructive forces, e.g. hurricane force wind, wave force, earthquake, etc.
- Require mobile home anchorage.
- Require retrofit of repetitive loss properties as a condition for receiving a building permit for other activities.
- Retrofit of buildings (by hazard).
- Design, construction, land use (by hazard):
  - Floods: flood proofing; regulatory frameworks; controlling parameters; flood-resistant design practices; benefit/cost/technical feasibility analysis; finished floor elevation 18 inches above 100 year flood level.
  - Earthquake: seismic safety design; construction; land use.
  - Wind / Storm: wind safety design; determining wind loading on structures; brace gable end roof framing; corrosion resistant hurricane clips; water resistant adhesives for shingles; trusses manufactured in accordance with local wind models; distance from tree to house must be greater than height of full grown tree; windborne debris impact standards.
- Multi-hazard design, construction, land use.
- Home owners hazard mitigation retrofit guide(s).
- Floods: establish building code requiring that all new construction or substantial improvements have the lowest floor elevated no lower than eighteen inches above base flood elevation.
  - FEMA requires the lowest floor of all new construction to be at the established base flood elevation.
- Building codes that will:
  - Regulate flood damage.
  - Regulate Storm Water drainage.
  - Include "safe room" provision to protect against tornadoes.
  - Require new or redeveloped mobile home parks to include a hardened facility for resident evacuation during emergency events, e.g. hurricanes, tornadoes.
  - Promote reduction in density and intensity in areas that have experienced repetitive damage.
  - Promote water conservation.
  - Mandate emergency water restriction measures.
  - Ensure wellfield protection.
  - Regulate handling of hazardous materials and waste on-site.
  - Protect beach/dune vegetation.
  - Prohibit hardening of the shoreline for purposes of preventing erosion.
  - Require drought tolerant vegetation.
  - Require spill contingency plan for marinas.
  - Address controlled burns.

5. Insurance Programs.

- Distribution of Floodplain Management Handbook: Current information on the National Flood Insurance Program and flood hazard mitigation.
- Conduct community flood insurance workshops.

6. Land Use Planning/Management: General.

- Establishment of "hazard zones."
- Special districts.
- Land acquisition.
  - Acquiring land located on barrier islands or Coastal High Hazard Areas.
  - Purchasing land where structures are subject to repeated damage from disasters.
- Hazard risk maps to aid public and private land management planning to:

- Minimize repetitive losses.
- Reduce vulnerability of existing development.
- Reduce vulnerability of new development.

- List and map repetitive loss properties.
  - Identify ways to reduce repetitive losses.
- Establish construction "set back (from hazard) lines" for new construction and reconstruction.
- Moratoriums on new development and construction in hazard areas.
- Establish "hazard district(s)", with taxing authority.
  - Districts would then fund such projects as:
    * Construction, repairs, upgrades to evacuation routes.
    * Retrofit of existing shelters.
    * Cost-sharing of building upgrades for new structures to be used as shelters.
    * Flood and wind retrofit demonstration projects and individual grants.
    * Public education programs.
    * Acquisition, relocation, elevation of repetitive loss properties.
    * Matching funds for state and federal grants.
- Add mitigation goals to the community's Comprehensive Growth Management Plan.
- Apply predictive models indicating population growth versus increased potential for risk and damage, as designated in-future land use maps included in the local comprehensive plan.

6.a Land Use Planning/Management. Specific: Floods.

- Floodplain Management Workshops.
- Post-Flood Training on Floodplain Management and Flood Insurance.
- Floodplain Management Handbook.
- Building(s) relocation, rebuilding.
- Establishment of "base flood elevations (benchmarks)"
- Provide information on flood proofing and retrofitting to home owners.
- Conduct flood proofing and reto-fitting demonstration projects.
  - Work with insurance industry, building supply companies, community and neighborhood associations. Document successes well, distribute findings.
- Train home owners to sandbag their property.
- Acquisition of repetitive loss properties.
- Purchase conservation easements to reduce development in floodplain areas.
- Assess, retrofit existing flood prone septic tank systems.
- Assist residential and commercial property owners with vulnerability inspections and identification of retrofit options.
- Beach management plans.
- Establish codes for "flood proofing standards."
- Identify and zone areas subject to wave action during storms.
  - Revise or enact codes to reduce debris-caused damages through:
    * Restricting construction or installation of structural (break away walls, decks, platforms, walkways) or ancillary structures (garden sheds, landscaping materials) that can become detached during wave actions.

7. Laws/Ordinances/Rules/Inspections.

- Crowd-control procedures.
- Emergency permitting procedures.
- Transportation routing, controls.
- Hazard risk disclosures in property transactions.
- Strengthen real estate disclosures of hazards and prior damages to structures.
  - Attach information to land titles.

- Change building codes and other ordinances to allow for a permitting moratorium immediately following disasters.
- Safety Inspections:
  - Risk reduction orders.
  - Establish post disaster programs, procedures for damage assessments, permitting and inspections.
- Establish an ordnance to establish a post-disaster community redevelopment task force that includes the various neighborhood and interest-based groups. A main focus of the task force is to encourage public participation in the post-storm redevelopment planning and review process.

8. Mitigation Committee.

- Establish committee to establish, review, evaluate mitigation projects and activities.
- Establish a formal agreement or ordinance detailing how shared interests will be coordinated or how conflicting interests will be resolved.
  - Identify procedures to resolve conflict between governmental entities arising from local mitigation strategy(ies).
- Establish a mitigation planning process to include time frame(s) for accomplishing local projects/activities, degree of public involvement in the planning process, and how local mitigation efforts will be coordinated in the future.
- Identify community mitigation personnel and resources.
- Establish an information network within community.
  - Participate in state and national information sharing networks, associations.
- Reconstruction (post disaster) strategies by hazard.
  - Form a "Reconstruction Task Force" comprised of citizens and local government staff to assist and guide mitigation activities.
- Review and reference all existing plans, policies, and ordinances that relate to public safety, hazard mitigation, and long-term recovery. Many of the same ideas - like public safety and loss reduction - are repeated in these documents. When collated together through an indexing process, these common themes will establish the guiding principles for a community's mitigation strategy.
  - Prepare a table or index to show where the local mitigation strategy criteria have been addressed in these existing documents.
  - Recommend plans, ordinances, policies for identified mitigation strategies and activities not addressed in existing documents.
- Review the goals, policies, and objectives of the community's Comprehensive Growth Management Plan.
  - Identify goals that should be included that address hazard mitigation and long-term recovery.
- Translate recommendations contained in Interagency Hazard Mitigation Team Reports or Strategy Papers developed in the aftermath of Presidentially declared disaster events into community mitigation projects and activities.
- Integrate mitigation strategy(ies) into the community's comprehensive emergency management plan.
- Provide a multi-hazard map of the community.
- Identify topic areas requiring additional study or research to support loss reduction.

9. Protection, Retrofit of Infrastructure and Critical Facilities.

- Non-structural mitigation projects.
- Survey, inventory buildings to estimate cost of rehabilitating to with stand known hazards (wind, flood, earthquake, etc.)
- Establish a GIS "critical facilities database." Use data to identify mitigation needs and opportunities.
  - Provide an inventory and map of all critical facilities within the community, including those vulnerable to damage from disasters. [Such as fire and police departments, wastewater treatment facilities, schools, etc.]
- Retrofitting public facilities:

  - Elevation of structures.
  - Structure relocation.
  - Structural reinforcement.
  - Strapping of utilities.
  - Installation of storm shutters or tie downs.
- Installing radio telemetry monitoring system for public utilities.
- Corrosion protection for metal connectors (roofs, walls) in coastal areas.
- Establish mitigation project "partnerships" with private organizations.
- Repair, retrofit, construct shelters.
- Provide specific retrofit guidance to property owners.
- Infrastructure Design and Maintenance:
  - Road Design and Maintenance Handbook.
  - Flexible, buried utility services.
  - Identification of transportation system improvements and protection, i.e. what highways should be targeted for increased capacity to allow for quicker evacuation from hazard areas?
- Emergency response planning: Pre-planned activities during events to minimize impacts to structures.

10. Public Awareness, Training, and Education.

- Hazard Identification and Mapping.
- Use of GIS.
- Hazard safety programs: non-structural mitigation techniques, planning and preparedness activities, response actions, post disaster actions, recovery activities.
- Educate local government administrators on benefits of mitigation and how to incorporate mitigation into community management.
- Educate local professional groups/associations (engineers, architects, building officials) on benefits of mitigation and how to incorporate mitigation into community management.
- Educate public about potential grant and loan sources for retrofit projects.
- Establish mitigation education project "partnerships" with private organizations.
- Work with insurance companies and mortgage companies to promote retrofits that will reduce building damage and lower insurance premiums.
- Emergency preparedness education programs for schools.
- Drills, exercises in homes, workplaces, classrooms, etc.
- Offer classes to citizens through fire department on Emergency Response Training (CERT).
- Non-structural hazard mitigation tasks.
- Emergency preparedness activities.
- Immediate care and response requirements.
- Public service announcements.
- Preparation videos, programs shown on local television station(s).
- Hazard "safety fairs."
- Hazard conferences, seminars.
- Hazard awareness weeks.
- Preparedness handbooks, brochures.
  - Distribution of hazard specific survival guides.
  - Distribution of "homeowner's guides to retrofit."
- Newsletters.
- Regular newspaper articles.
- Mitigation media (photo, video) archives.
- Direct mailings.
- Utility bill inserts.
- Distribution of "video how to" guides to target audiences.
- Building retrofit training.

- Mitigation technical service centers._
- Publications, videos, CD-ROMS promoting mitigation and preparedness.
- WEB site.
- FAX-back system which provides public safety information.
- Risk Communication Programs:
  - Risk reduction techniques.
  - Newsletters.
  - Hazard identification, risk assessment.
  - Public hearings.
  - Risk maps.

11. Public Health and Emergency Medical Care, & Education.

- Stockpile medicines and supplies.
- Emergency water and sanitation resources, plans, procedures.
- Information and instructions for hygiene, sanitation, preparing food/water, etc.
- Encourage pre-disaster personal health and well being, e.g. current physical exams, inoculations, etc.
- First aid training programs.
- Animal and vector control programs.
- CPR Training.

12. Public Protection.

- Evacuation studies and plans.
- Designate evacuation routes.
  - Erect warning and evacuation route signs.
- Survey, designate shelters.
  - Inspect shelters.
  - Identify specific shelter reto-fit projects.
- Promote in-house shelters.
- Warning systems.
  - Tornado sirens.
  - Nuclear disaster sirens and loudspeakers.
  - Telephone warning system.
- Installing emergency power generators (critical public facilities).
- Emergency communication and information systems. (Ensure that an effective communications network between local and state officials and the public during hazard events is developed and implemented.)
  - NOAA weather receivers.
  - Emergency Alert System (formally Emergency Broadcast System).
  - Public service announcements.
  - Joint media information centers.
- Hazard detection systems:
  - River, stream gauges.
  - Rain gauges.
  - Wind gauges.
  - Meteorological sensors.
  - Wave gauges.
  - Tide gauges.
- Emergency response planning: Pre-planned activities during events to minimize impacts, i.e. sand bag operations.
- Hazard Vulnerability Assessment studies; Risk Mapping.

13. –Science and Technology.

- Technology transfer programs.
- Use geographic information technology to support hazard identification and risk assessment.
  - Computer modeling (Geographic Information Systems) - Risk mapping.
  - HAZUS computer program - Risk mapping. FEMA's loss estimation model (aka HAZUS) includes a wealth of information on critical facilities. A tool to support local government hazards mapping.

14. Other.